

Utilization of the LADAS model within Emergency Response Systems in Korea

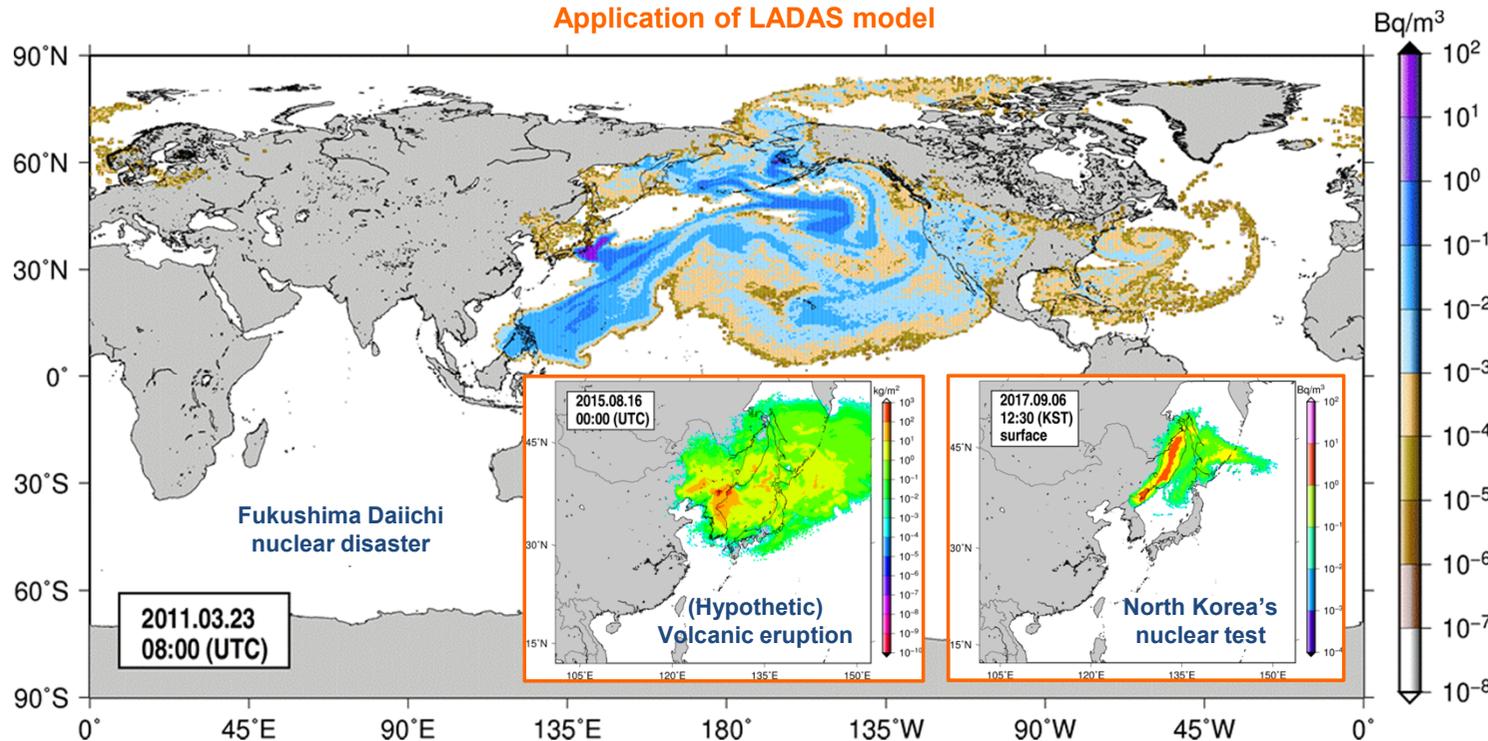


Kihyun Park, Byung-II Min, Sora Kim, and Kyung-Suk Suh
 Korea Atomic Energy Research Institute (KAERI), Republic of Korea, khpark77@kaeri.re.kr



Lagrangian Atmospheric Dose Assessment System (LADAS) @ KAERI

Application of LADAS model



- LADAS (2006)**
 - ✓ KAERI's own ATDM
 - ✓ global / regional / (local) scale
 - ✓ fast calculation (MPI)
 - ✓ use KMA's NWP data
 - ✓ ATDM in RAPS-K
- LADAS-Volcanic Ash (2015)**
 - ✓ derivative of LADAS (VATDM)
 - ✓ based on LADAS-regional
 - ✓ fast calculation (simple physics)
 - ✓ (default) VATDM in VDRS



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Introduction: Emergency Response Systems utilizing LADAS model



- ### Common features
- ✓ **Governmental Use Only (not opened to public)**
 - ✓ **Web based GUI**
 - ✓ **Real-time NWP data (KMA)**
 - ✓ **Provide countermeasures**
 - ✓ **Scenario development → Training program (feedback)**
 - ✓ **Almost get ready for operation**

LADAS in RAPS-K

- ✓ **Operation by KAERI (nuclear accident)**
- ✓ **Global / Regional (East Asia) / (Local)**
- ✓ **Related governmental agencies (User Group)**
- ✓ **LADAS → Dose calculation**
- ✓ **Employ HPC for fast calculation**

LADAS-VA in VDRS

- ✓ **Operation by MOIS (volcanic eruption)**
- ✓ **Regional (Far East Asia)**
- ✓ **Public officers in MOIS / local governments**
- ✓ **LADAS-VA → fallout ash / PM10 / airway**
- ✓ **Use virtual calculation server (docker image)**



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Radiological Accident Preparedness System in Korea (prototype)

RAPS - K

평가시작 공지사항 버그 리포트 평가기록 설정 로그아웃

대기확산평가(LADAS) ✓ Atmospheric dispersion

해양확산평가(LORAS) ✓ Oceanic dispersion

선량평가 ✓ Dose calculation

Use HPC for fast calculation



RAPS - K

Radiological Accident Preparedness System

평가시작



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RAPS - K 평가시작 공지사항 버그리포팅 평가기록 설정 로그아웃

LADAS ✓ Radionuclides (particle/noble gas)

대기확산평가(LADAS)
입력파일 생성 지역 범위

동북아시아 지구규모
East Asia (regional) **global**

MAP **LADAS results**

위도 39.8 경도 126.9 *주요 도시 위치 표시

시간 2016-05-02 06:00 PSay

고도 100m

GRAPH
sampling sites: major cities

강계 Total

- 강릉
- 개성
- 고베
- 광저우
- 광주
- 교토
- 군산
- 나고야
- 나카타
- 대구
- 대전
- 도쿄
- 베이징
- 부산
- 사포로
- 상하이
- 샌타이
- 수원

MORE RESULTS **result download**

모든 그래프 이미지 다운로드 모든 지도 이미지 다운로드 평가결과 항목 파일 다운로드



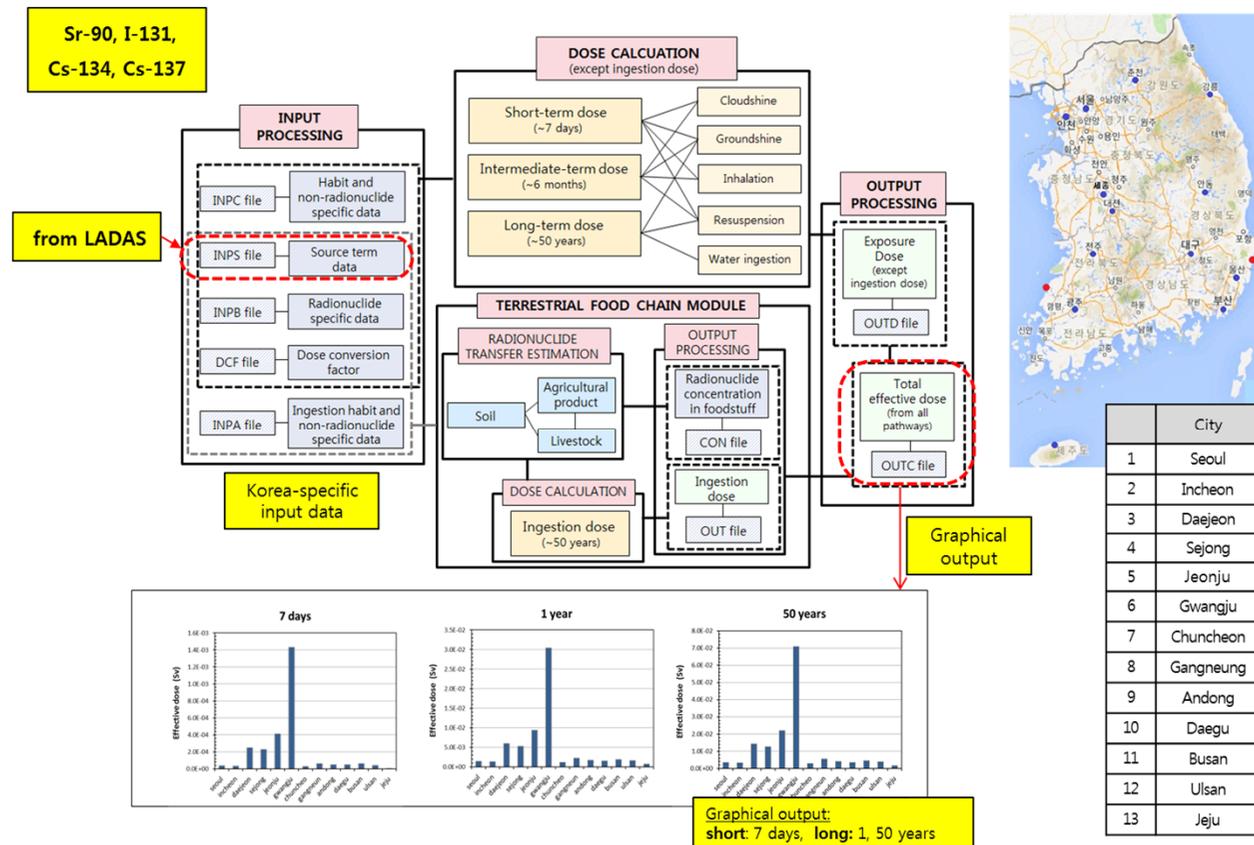


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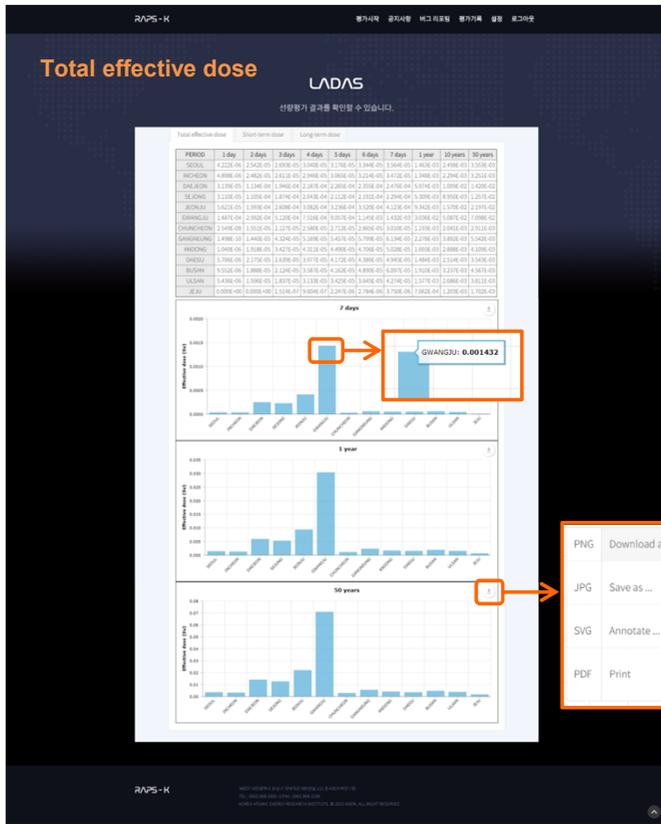
Dose calculation module



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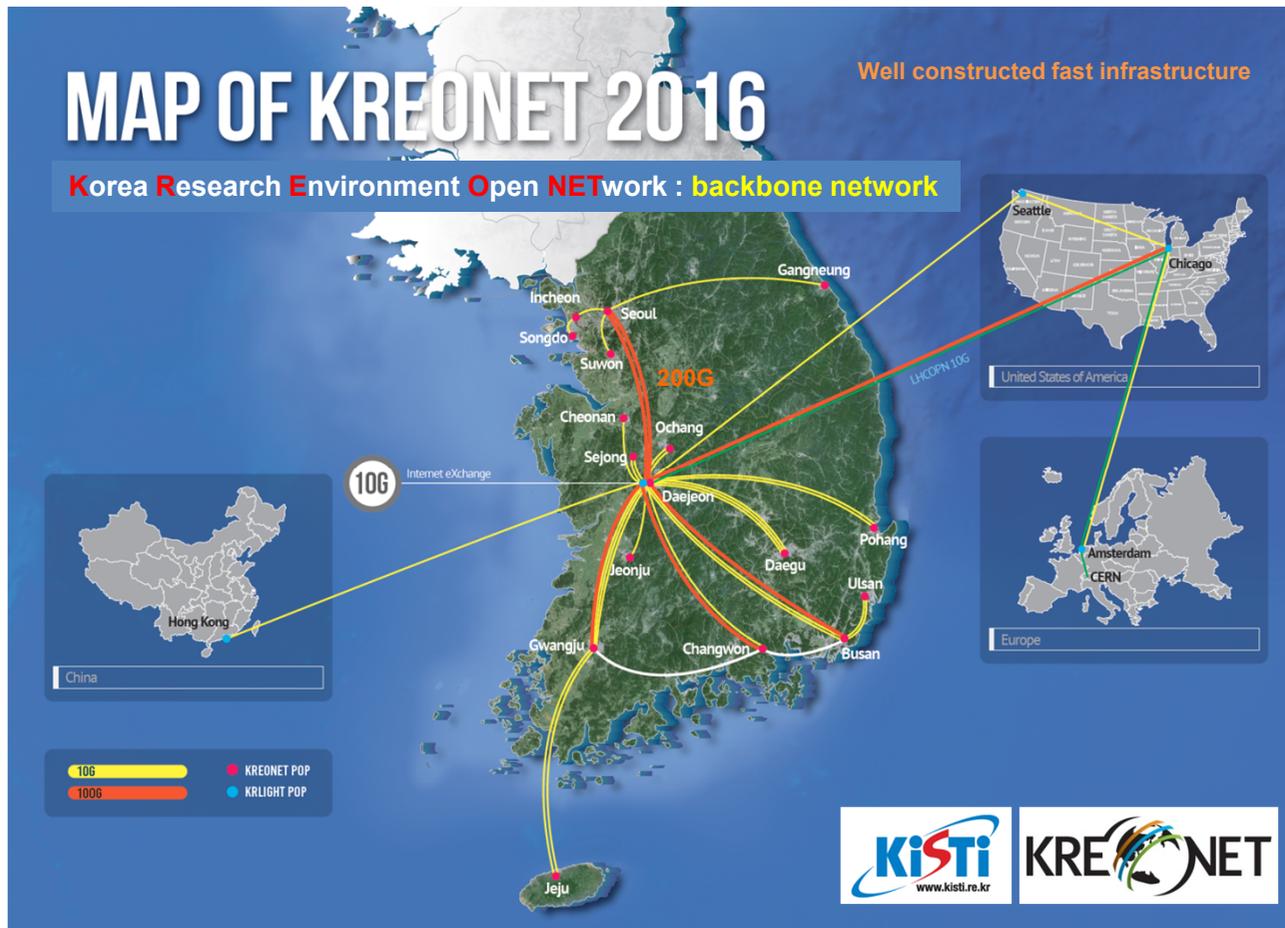
- ✓ Based on LADAS (atmospheric dispersion) results
- ✓ Use Korea-specific input parameters
- ✓ Food chain model (terrestrial/aquatic)



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Real-time NWP data receiving via KREONET for RAPS-K operation



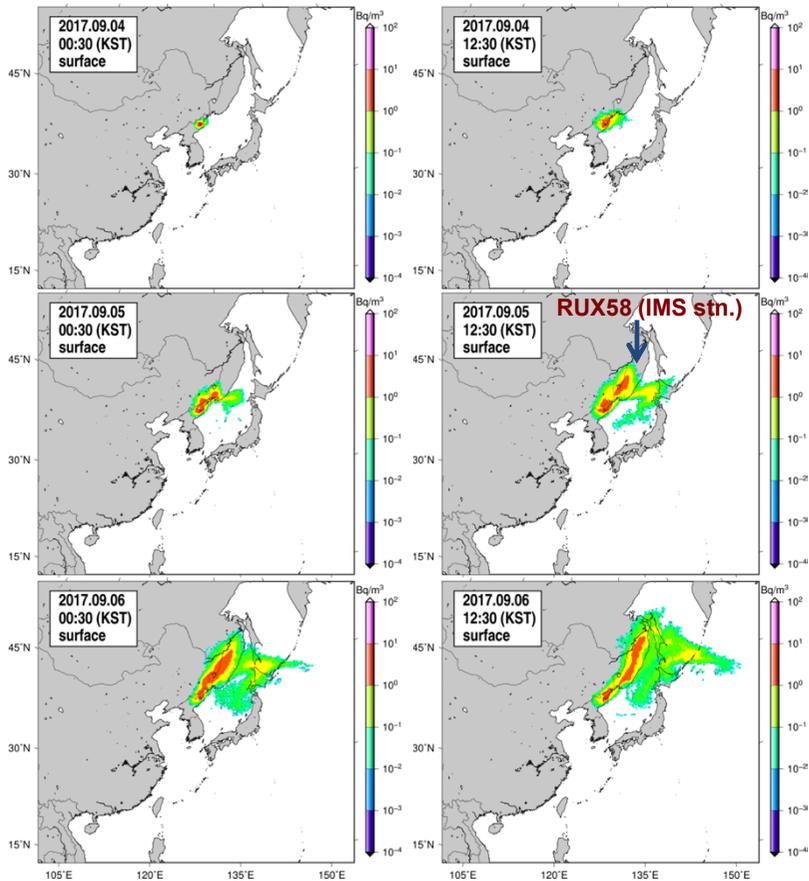
- ✓ **KREONET backbone:** private/internal network with 1~100G (max 200G)
- ✓ **KISTI to KAERI:** 1G private/exclusive use



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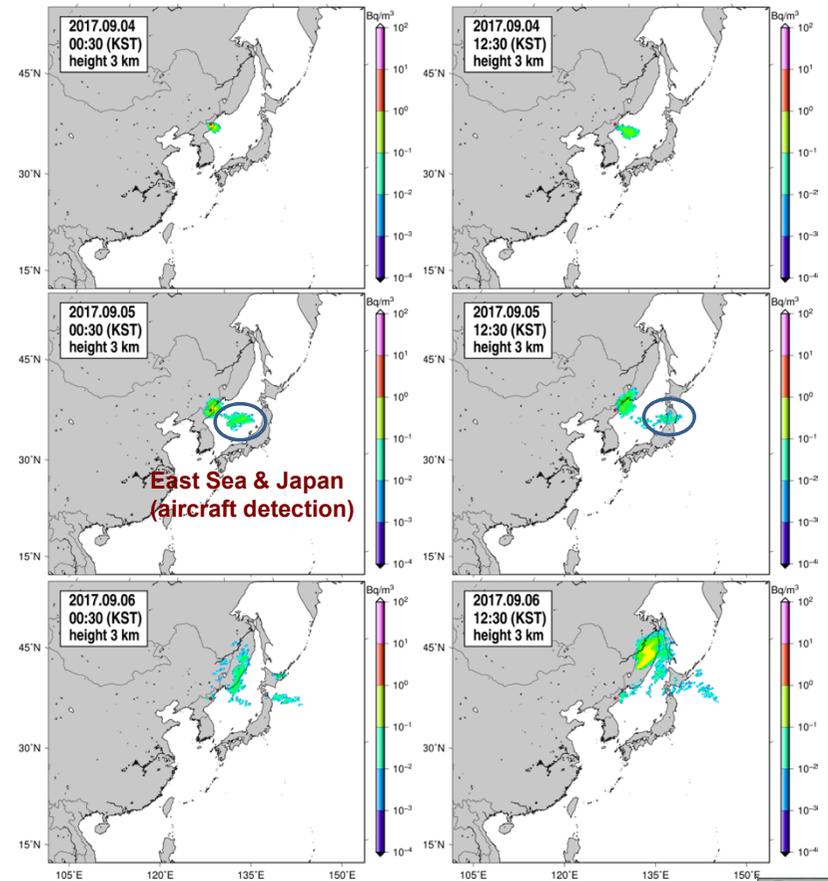


North Korea's 6th nuclear test

time & location (KMA)
 - 2017-09-03 12:29 KST
 - near Punggye-ri NTS (41.302°N, 129.080°E)

Xe-133 emission scenario
 - immediate emission
 - 72h continuous release

possible detection site
 - RUX58 station (surface)
 - middle of East Sea & Akita in Japan (aircraft)
 - undetectable in Korea (not detected)



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화산재해대응시스템

화산재확산 피해추정 기상상황 화산정보 매뉴얼 시스템 관리

admin001 (화산 시스템 / 관리자)님
마이페이지 로그아웃

eruption information

분화정보

국가	일본
화산명	아소산
분화일시	2018-01-30 02:00
분연주 높이	20,000 m
분화지속시간	6 시간 (기본값)

초기화 변경

[관심] 분화 대응 진행중

위성영상

2018-03-21 16:45 (KST)

대한민국 주변 화산 정보

화산정보

화산명	아소산
국가	일본
화산타입	칼데라
위도 / 경도	32.884N / 131.104E
서울까지 거리	641 Km

volcano information

분화이력

상황판 status

- ▶ 2018-03-20 (17:27) (훈련) 통보문 접수
- 기상청 통보문 -> 행정안전부
- ▶ 2018-03-20 (17:26) (훈련) 통보문 접수
- 기상청 통보문 -> 행정안전부
- ▶ 2018-03-20 (17:25) (훈련) 통보문 접수
- 기상청 통보문 -> 행정안전부
- ▶ 2018-03-16 (12:30) (훈련) 기상청 활용 최종결과 적용 완료(PUFF)
- 화산재해 대응시스템
- ▶ 2018-03-16 (12:30) (훈련) 계산서버 연산 최종결과 수신(PUFF)
- 화산재해 대응 시스템
- ▶ 2018-03-16 (12:30) (훈련) 기상청 활용 최종결과 적용

공지사항 notice

- 9 백두산 화산대응기술개발사업,계..
- 8 일본 온타케 화산 분화 보고서
- 7 백두산 폭발 대비, 한-중 공..
- 6 「한국화산방재학회」 창립총회 개최
- 5 메인화면 UI 변경

주요메뉴 바로가기

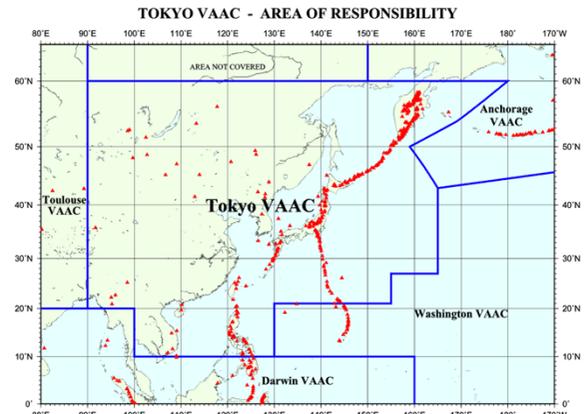
- 화산재해 상세조회
- 화산재해 분석보고서
- 위기대응 실무매뉴얼

VDRS home

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매뉴얼다운로드 사이트맵

Volcanic Disaster Response System (prototype)



Real-time eruption information from
Tokyo VAAC & KMA



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Ash dispersion

화산재확산시스템

화산재확산 | 피해추경 | 기상상황 | 화산정보 | 매뉴얼 | 시스템 관리

admin001 (화산 시스템 / 관리자) 님 | 마이페이지 | 로그아웃

지도보기 | 차트보기 | 표로보기

map | chart | table

LADAS-VA (default)
 PUFF
 FALL3D

초기화 | 변경

[예방] 사용자 선택 분화경보

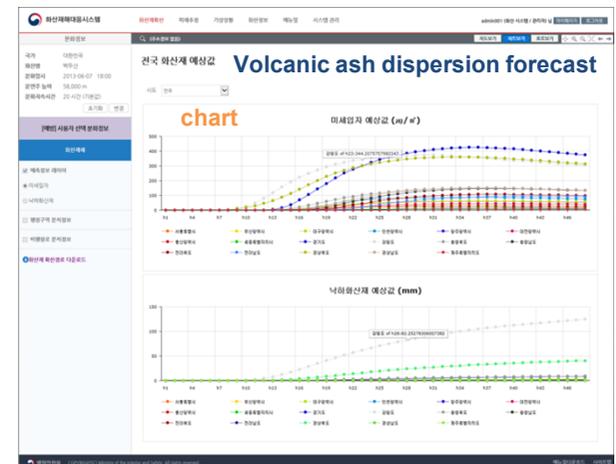
화산재해

예측정보 레이어
 미세먼지 PM10
 낙하화산재 fallout ash
 행정구역 분석정보 Admin area
 비행항로 분석정보 airway

화산재 확산경로 다운로드

result download

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화산재확산시스템

화산재확산 | 피해추경 | 기상상황 | 화산정보 | 매뉴얼 | 시스템 관리

admin001 (화산 시스템 / 관리자) 님 | 마이페이지 | 로그아웃

Volcano DB

화산명	위치	국가	지각	활동성	최고산정점	최대 분출량
1	백두산	중국·북한	복합	활동성	2769m	2,769m
2	한라산	대한민국	복합	활동성	1945m	1945m
3	대관령	대한민국	복합	활동성	1470m	1470m
4	지리산	대한민국	복합	활동성	1915m	1915m
5	태백산	대한민국	복합	활동성	1585m	1585m
6	설악산	대한민국	복합	활동성	1485m	1485m
7	인제산	대한민국	복합	활동성	1470m	1470m



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damage prediction

- ✓ overall
- ✓ in airway
- ✓ in agriculture
- ✓ in public health report

화산재해 대응시스템 | 화산재해분석 | 피해추정 | 기상상황 | 화산정보 | 매뉴얼 | 시스템 관리

화산재해 분석보고서 | Analysis report

화산 분화 정보 | 2018. 1. 30(화) | 지진발생관리과

1.30 일본 아오산 화산 분화상황 보고

2018. 1. 30(화) 일본 아오산 화산 분화에 따른 정보분석 보고서

개요
 화산 분화: 아오산 화산
 분화일시: 2018. 1. 30(화) 0시 0분(한국시간) (K기상청 화산정보발표: 30 17:00)

위 치: 일본(32°58'47N, 131°10'44W)
 분화구 고도: 1592m

「대응 화산폭발」 위기대응 실무매뉴얼
 response manual
 2017. 4.

총괄 피해추정 | overall damage estimation

2013.06-07(일) ~ 2013.06-09(월)	총 손상횟수	총인명	도착	경정량
총계	3,453	1,163	1,156	67%
인명 고통	2,724	910	908	67%
집주 고통	168	57	56	67%
집차 고통	494	173	168	69%
제주 고통	67	23	24	70%

농작물 피해추정

분류	농작물 수	생산량	손실량	손실률
총계	130	30,975,274	21,910,712	70.74
식량작물	27	20,061,123	15,252,763	76.03
노지작물	65	8,119,509	5,684,251	70.01
시설작물	38	2,794,642	973,698	34.84

보건 피해추정

비사고 사망자 (명)	후종가림용 사망자 (명)	실종관계 사망자 (명)
전체	65세 이상	65세 미만
231 - 407	177 - 353	444 - 620
	434 - 610	1,602 - 1,779
		596 - 772

보건 피해추정 | damage in public health

지역별 피해추정 개요

시도	비사고 사망자 (명)	후종가림용 사망자 (명)	실종관계 사망자 (명)
총계	231 - 407	177 - 353	444 - 620
서울시	11 - 15	9 - 13	18 - 22
부산시	3 - 6	3 - 6	6 - 9
대구시	13 - 18	10 - 15	23 - 28
인천시	7 - 12	5 - 10	12 - 17
광주시	2 - 5	1 - 4	6 - 9
대전시	5 - 9	5 - 9	11 - 15
울산시	2 - 4	2 - 4	4 - 6
세종시	1 - 2	1 - 2	2 - 3
경기도	63 - 91	54 - 82	111 - 139
			105 - 133
			411 - 439
			147 - 171



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Simulation for Hypothetic Eruptions

By using the LADAS-VA model, we performed a series of simulations for (year-round) hypothetic eruptions of several representative volcanoes around Korea, such as Mt. Baekdu (Changbaishan), Asosan, Ulreung, Fujisan, and Shikotsu (Taramaisan).

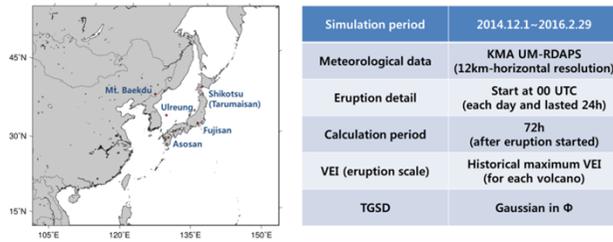


Fig 1. Coverage of the UM-RDAPS meteorological data and 5 representative volcanoes around Korean Peninsula with some simulation information.

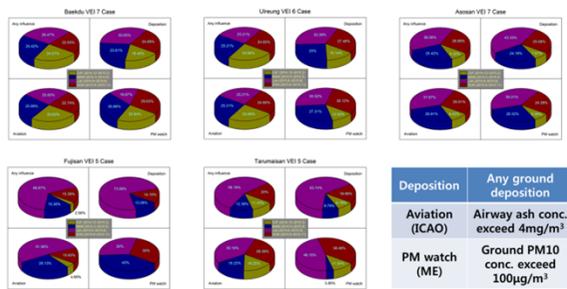


Fig 2. Ratio of influenced days for each season classified into three impact factors (deposition, aviation, and PM watch) with criteria of influence.

Seasonal Influence

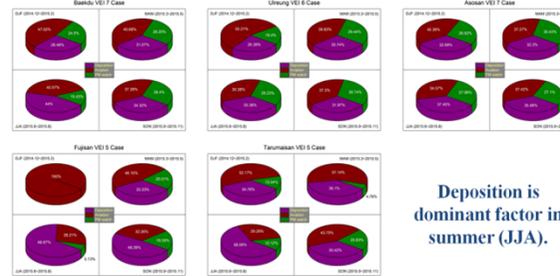


Fig 3. Comparison of seasonal ratio of influenced days due to each impact factor for hypothetic eruptions of representative volcanoes.

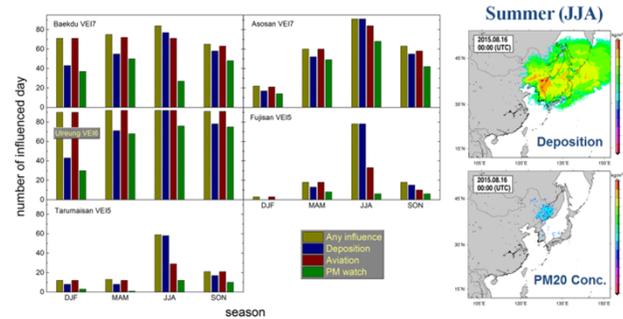


Fig 4. Number of influenced days by hypothetic eruptions of representative volcanoes due to each impact factor for each season (of eruption).

Illustrative Examples

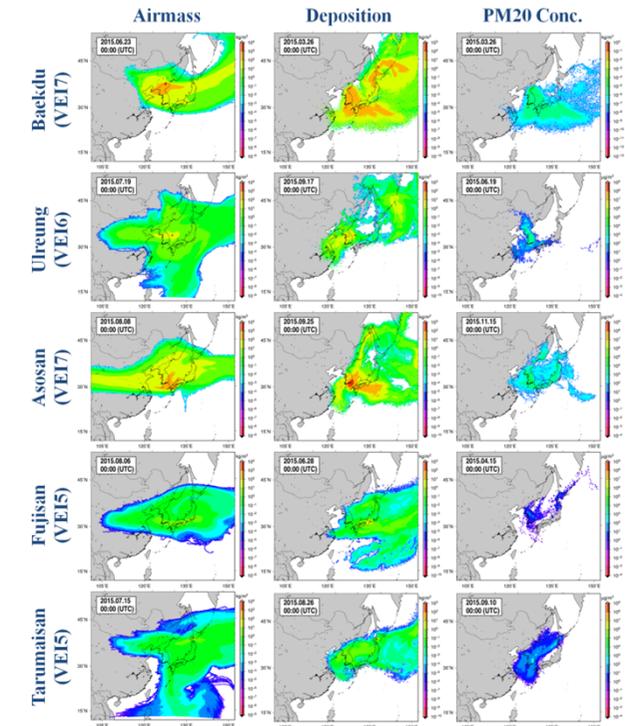


Fig 5. Examples of some hypothetic eruptions which influenced on Korean peninsula.



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과학기술정보통신부
Ministry of Science and ICT



행정안전부
Ministry of the Interior and Safety



기상청
Korea Meteorological Administration



한국원자력연구원
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Korea Institute of Science and Technology Information



Acknowledgement

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